



IN MEMORIAM

Shang Fa Yang
Professor of Vegetable Crops
UC Davis
1932 – 2007

Shang Fa Yang, Emeritus Professor at the University of California, Davis, passed away suddenly and unexpectedly on February 12, 2007 at the age of 74. As the discoverer of the pathway for the biosynthesis of ethylene and the namesake of the Yang Cycle for the regeneration of methionine that initiates this pathway, he leaves a legacy of notable contributions to plant biochemistry and to the University of California.

Shang Fa Yang was born in 1932 in Taiwan where he received his B.S. and M.S. degrees in Agricultural Chemistry from the National University in the late 1950's. He received a scholarship to do graduate work at Utah State University and received his Ph.D. there in 1962 in Plant Biochemistry. He then came to the University of California, Davis, where he did postdoctoral work with Dr. Paul K. Stumpf on higher plants lipid metabolism. Shang Fa was eager to see the East Coast and obtained a fellowship at New York University Medical School where he met his wife, Eleanor, who was studying accounting at NYU. One year later, he returned to California and to plant biochemistry as a postdoctoral scientist at Scripps Institute of Oceanography in La Jolla, CA.

In 1966, Shang Fa was hired as an assistant biochemist in the Department of Vegetable Crops at the University of California, Davis. A strong advocate for his hiring was Harlan K. Pratt, a pioneering researcher in ethylene physiology with whom he initially shared a lab in the newly constructed Mann Laboratory. Shang Fa's early studies on ethylene were assisted by the homemade gas chromatograph that Pratt had cobbled together. Although large and cumbersome, that instrument could measure the parts-per-million concentrations of ethylene produced by plants and remained in use for over 35 years. Armed with this tool and his broad knowledge of chemistry and biochemistry, Shang Fa set out to explore plant ethylene biology.

Since 1934, when ethylene was conclusively shown to be produced by ripening fruit, considerable effort had been expended to discover how the volatile hormone was made in plants. The modern search for the ethylene biosynthetic pathway began in 1965 when it was observed that plants converted methionine to ethylene. This discovery led many scientists around the world on a quest to identify the subsequent steps in the pathway. Shang Fa's first paper on ethylene in 1966 (one of more than 200 publications in his career) explored the intricacies of an in vitro model system for the generation of ethylene from methionine, and his group made many important contributions during this period. In 1977, Shang Fa and his Ph.D. student, Douglas Adams, showed that methionine was converted to S-adenosylmethionine (SAM) and that SAM was a precursor of ethylene. Doug Adams also discovered that when tissues were kept under low oxygen conditions, a treatment known to suppress ethylene biosynthesis and thereby promote postharvest storage of fruits and vegetables, a metabolic intermediate accumulated. The pace quickened and a real race ensued among various labs to identify the intermediate between SAM and ethylene. This intensive effort culminated in 1979 when Adams and Yang identified 1-aminocyclopropane-1-carboxylic acid (ACC) as the final precursor of ethylene.

Assays for ACC were quickly developed and physiological studies into the regulation of ethylene biosynthesis accelerated. For example, Shang Fa's group demonstrated that under low oxygen conditions, such as root flooding, ACC could accumulate and be transported in the xylem to the shoot and subsequently converted to ethylene, serving as a translocatable signal of root stress to the shoots. His group also discovered that ACC could be conjugated to malonate, resulting in an alternative pool of ACC in plant tissues. It had been noted that methionine pools in plants are too low to sustain the observed rates of ethylene synthesis, but Shang Fa and his students resolved this controversy by demonstrating that the methylthio group released from SAM during the synthesis of ACC is recycled to replenish methionine levels. The reactions of this recycling pathway were subsequently christened the Yang Cycle in plant biochemistry texts. As the tools became available for cloning and characterizing the genes responsible for the steps in ethylene biosynthesis, Shang Fa contributed to many studies of the regulation of those genes in fruit ripening, plant growth, wounding and stress responses. He wrote numerous reviews and book chapters that defined ethylene biosynthesis and its role in plant biology for a generation of students and researchers.

In all his work, Shang Fa continually linked his discoveries to practical applications in postharvest biology and plant growth regulation. He used what he knew about physiology to learn more about ethylene biosynthesis, and he applied what he learned about ethylene biosynthesis to contribute to improvements in postharvest storage conditions. He was known for his clarity of thought and the ability to identify and design critical experimental tests of hypotheses. Shang Fa always maintained an open mind and was willing to challenge accepted ideas, even his own, when they proved untenable in the face of experimental data.

Shang Fa had an uncommon faith in humanity and urged his students to always expect the best of people. The coupling of an affable nature and a genuine concern for his students and colleagues enabled Shang Fa to assemble a powerful and effective research group that shared his vision and strove to match his intensity. He also developed an extensive and international network of friends and colleagues. Despite his many honors, he remained humble and always willing to share credit for the many discoveries coming out of his lab or to acknowledge the priority of other groups.

Shang Fa figured prominently at many national and international research conferences over the years and served on the editorial boards of leading journals and as a member of several learned societies. He won many awards and honors, including the Campbell Award of the American Institute of Biological Sciences in 1969, a Guggenheim Fellowship in 1982, the International Plant Growth Substances Association Research Award in 1985, and the Outstanding Researcher Award from the American Society of Horticultural Science in 1992. Shang Fa was named the UC Davis Faculty Research Lecturer in 1992. In 1990 and 1992, he was elected to the National Academy of Sciences, USA and to the Academia Sinica, Taiwan, respectively. In 1991, he received the prestigious international Wolf Prize in Agriculture.

After taking early retirement from University of California in 1994, Shang Fa served as Professor in the Department of Biology at Hong Kong University of Science and Technology from 1994 to 1997, where he established an active research group, and as a Distinguished Research Fellow and the Director of the Institute of Botany at Academia Sinica, Taipei, Taiwan. From 1996 to 1999, he was Vice President of the Academia Sinica and directed its numerous research institutes.

Shang Fa is survived by his wife Eleanor and two sons, Albert and Bryant, who have pursued careers in engineering and chemistry, respectively. While future plant biologists will know of Shang Fa through the Yang Cycle and his many other contributions to our field, students and colleagues who were fortunate enough to know him personally will also remember his humor, his humanity, and his sparkling intellect.

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